The Brattle Group

The Current State of U.S. Demand Response

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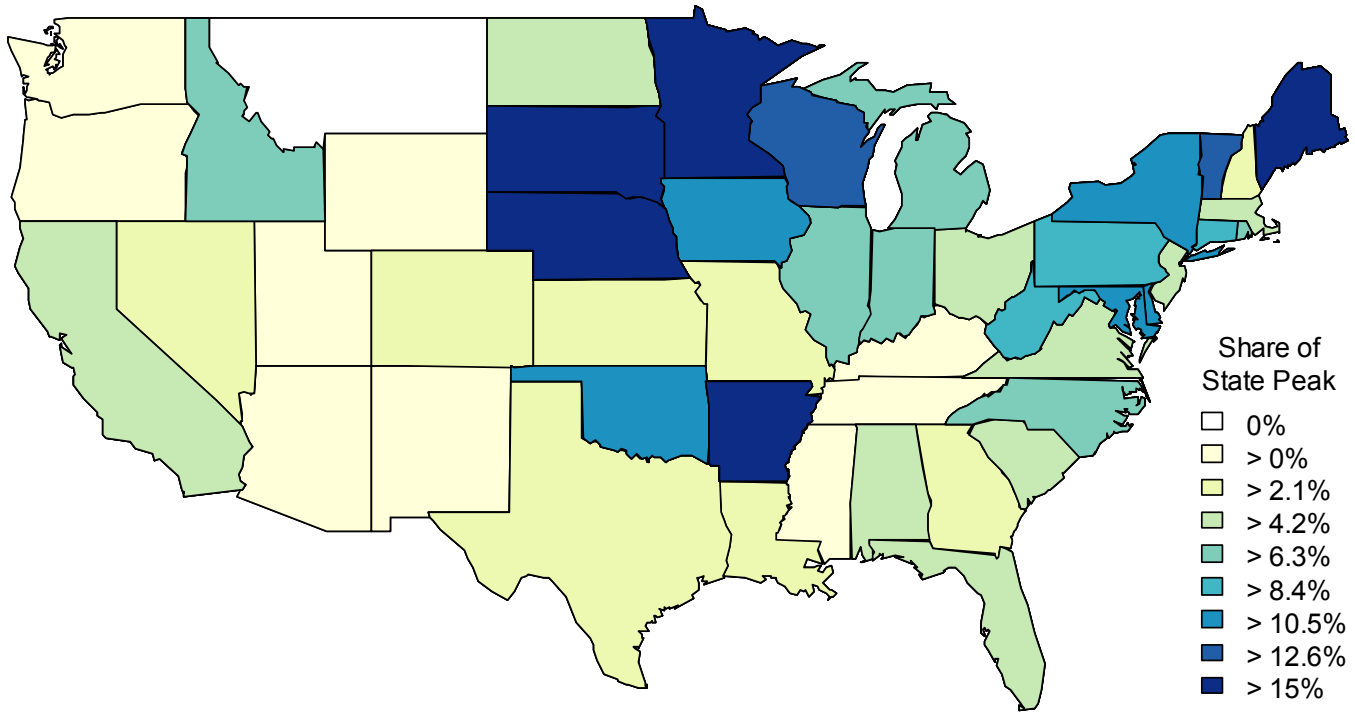
www.brattle.com

The national landscape of demand response (DR)

Peak Demand Reduction Capability (as Reported to FERC)



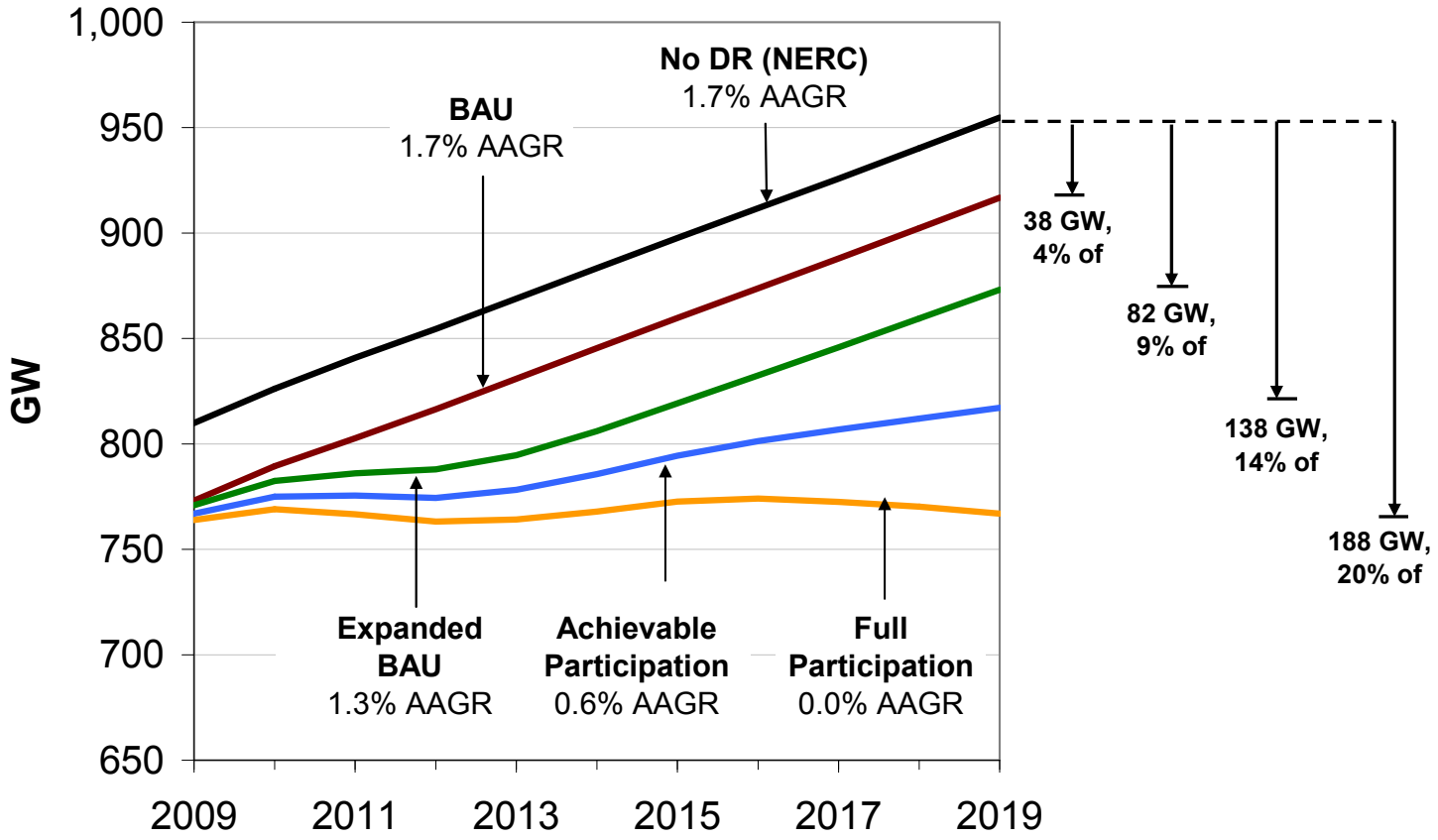
This amounts to 53 GW of peak reduction capability (6% of U.S. peak)

Source: Derived from reported DR capability in 2010 FERC Assessment of Demand Response & Advanced Metering and state system peak projections in 2009 FERC National Assessment of Demand Response Potential

Note: For further discussion, see Kelly Smith and Ryan Hledik, "DR Drivers," Public Utilities Fortnightly, January 2012

In 2009, Brattle identified 188 GW of DR potential

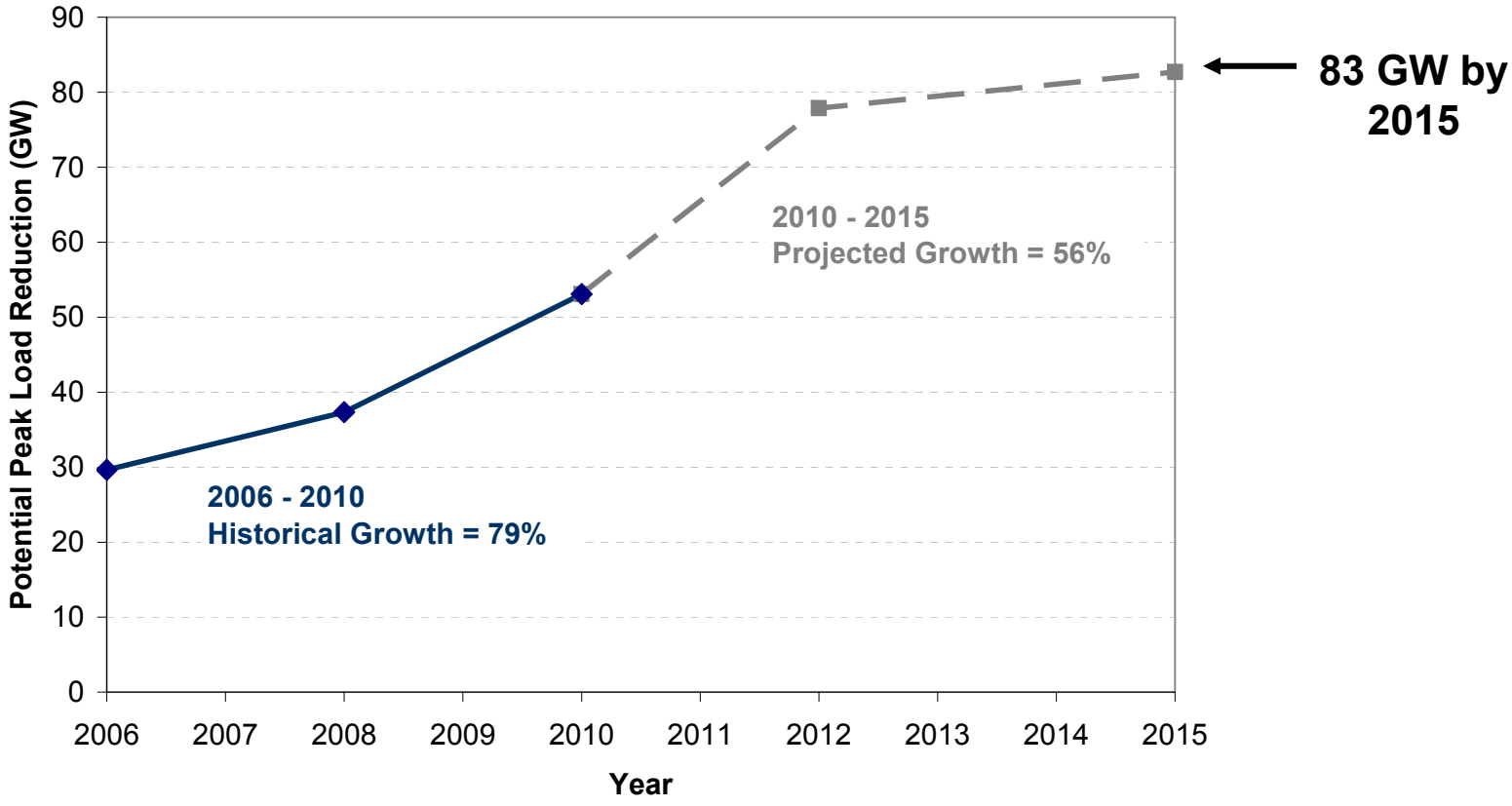
U.S. Peak Demand Projections



Source: 2009 FERC National Assessment of Demand Response Potential

FERC data suggests that we will get closer to our DR potential over the next five years

Historical and Projected U.S. Demand Response



Source: Adapted from 2010 FERC Assessment of Demand Response & Advanced Metering

Some challenges must still be overcome to achieve the potential

- Lack of strong financial incentives for utilities
- Short-term capacity surplus is limiting DR value in some markets
- Regulatory concerns over customer backlash
- Market design limitations
- Constraints on third-party participation

New developments could redefine the landscape

Policy initiatives

- State policy requiring dynamic pricing
- Demand-side prioritization in state policy
- FERC policy to promote energy market integration
- Federal funding for smart grid projects

Wholesale markets

- Changing supply-demand balance in capacity markets
- Renewables integration needs
- Increased role of aggregators

Retail markets

- Recession = greater electricity cost awareness
- Expansion of "green" segment of customers (e.g., EV adoption)
- "IT revolution" making tech available at lower cost

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Suggested reading

Kelly Smith and Ryan Hledik, "Drivers of Demand Response Adoption: Past, Present, and Future," *Public Utilities Fortnightly*, January 2012.

Ahmad Faruqui and Doug Mitarotonda, "Energy Efficiency and Demand Response in 2020: A Survey of Expert Opinion," The Brattle Group, November 2011.

Ahmad Faruqui, Ryan Hledik, Armando Levy, and Alan Madian "Smart Pricing, Smart Charging," *Public Utilities Fortnightly*, October 2011.

Sam Newell, "DR Distortion: Are Subsidies the Best Way to Achieve Smart Grid Goals?" *Public Utilities Fortnightly*, November 2010.

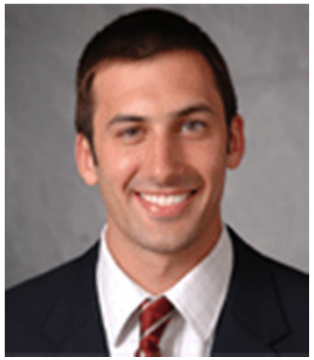
FERC, "National Action Plan on Demand Response," prepared by The Brattle Group, GMMB, Customer Performance Group, and Definitive Insights, June 2010.

FERC, "A National Assessment of Demand Response Potential," prepared by The Brattle Group, Freeman, Sullivan & Co. and Global Energy Partners, June 2009.

Ahmad Faruqui, Ryan Hledik, Samuel A. Newell, and Johannes P. Pfeifenberger, "The Power of Five Percent," *The Electricity Journal*, October 2007.

Ahmad Faruqui, Attila Hajos, Ryan Hledik, and Sam Newell, "Fostering Economic Demand Response in the Midwest ISO," *Energy: The International Journal*, October 2009.

Bio



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Ryan Hledik is a senior associate of The Brattle Group with expertise in assessing the economics of smart grid investments and policies. He has consulted to utilities, policymakers, technology firms, government labs, research organizations, and wholesale market operators. His contributions have included the development of widely cited models for the economic valuation of smart grid programs, serving as a member of a U.S. Department of Energy advisory group to review the activities of Smart Grid Investment Grant recipients, and providing strategic advice to firms implementing new smart grid initiatives.

Additionally, Mr. Hledik has been the lead developer of several energy market simulation tools for the purposes of wholesale price forecasting, asset valuation, and environmental impact analysis. A frequent presenter on the economics of the smart grid, he has recently spoken at events throughout the United States, as well as in Brazil, Canada, Korea, Saudi Arabia, and Vietnam.

Mr. Hledik received his M.S. in Management Science and Engineering from Stanford University, where his concentration was in Energy Economics and Policy. He received his B.S. in Applied Science from the University of Pennsylvania, with minors in Economics and Mathematics. Prior to joining The Brattle Group, Mr. Hledik was a research assistant with Stanford University's Energy Modeling Forum and a research analyst at Charles River Associates.

About *The Brattle Group*

The Brattle Group provides consulting and expert testimony in economics, finance, and regulation to corporations, law firms, and governments around the world.

We combine in-depth industry experience, rigorous analyses, and principled techniques to help clients answer complex economic and financial questions in litigation and regulation, develop strategies for changing markets, and make critical business decisions.

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- Cost of Capital
- Demand Forecasting and Weather Normalization
- Demand Response and Energy Efficiency
- Electricity Market Modeling
- Energy Asset Valuation
- Energy Contract Litigation
- Environmental Compliance
- Fuel and Power Procurement
- Incentive Regulation
- Rate Design, Cost Allocation, and Rate Structure
- Regulatory Strategy and Litigation Support
- Renewables
- Resource Planning
- Retail Access and Restructuring
- Risk Management
- Market-Based Rates
- Market Design and Competitive Analysis
- Mergers and Acquisitions
- Transmission

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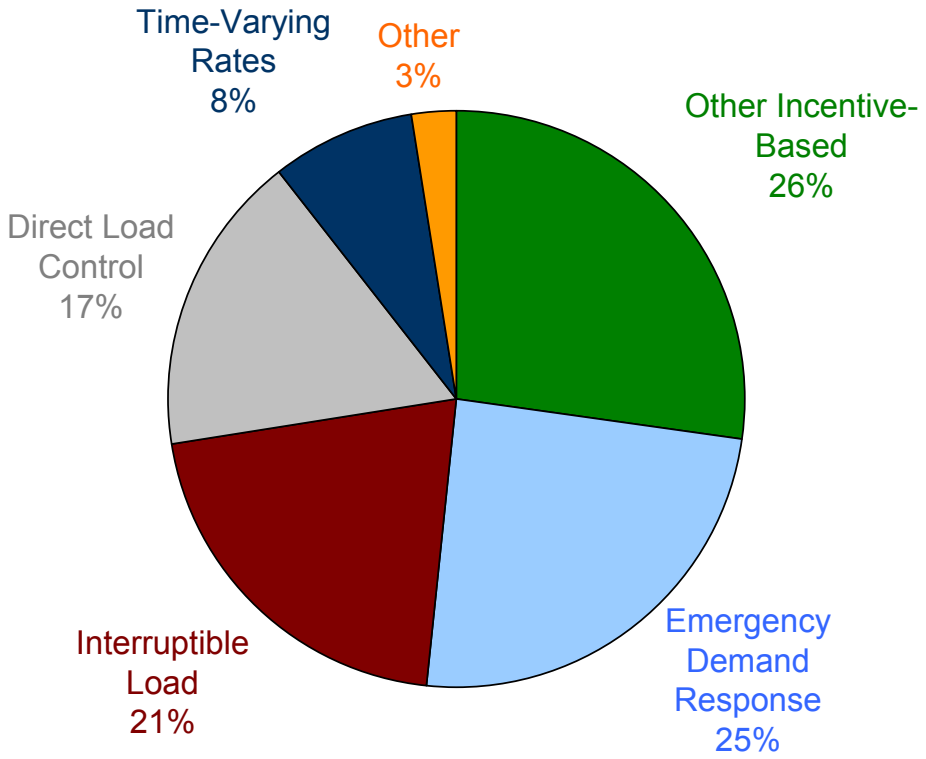
Appendix:
The emerging DR landscape

The current DR program portfolio is fairly diverse

U.S. DR Programs (Share of MW)



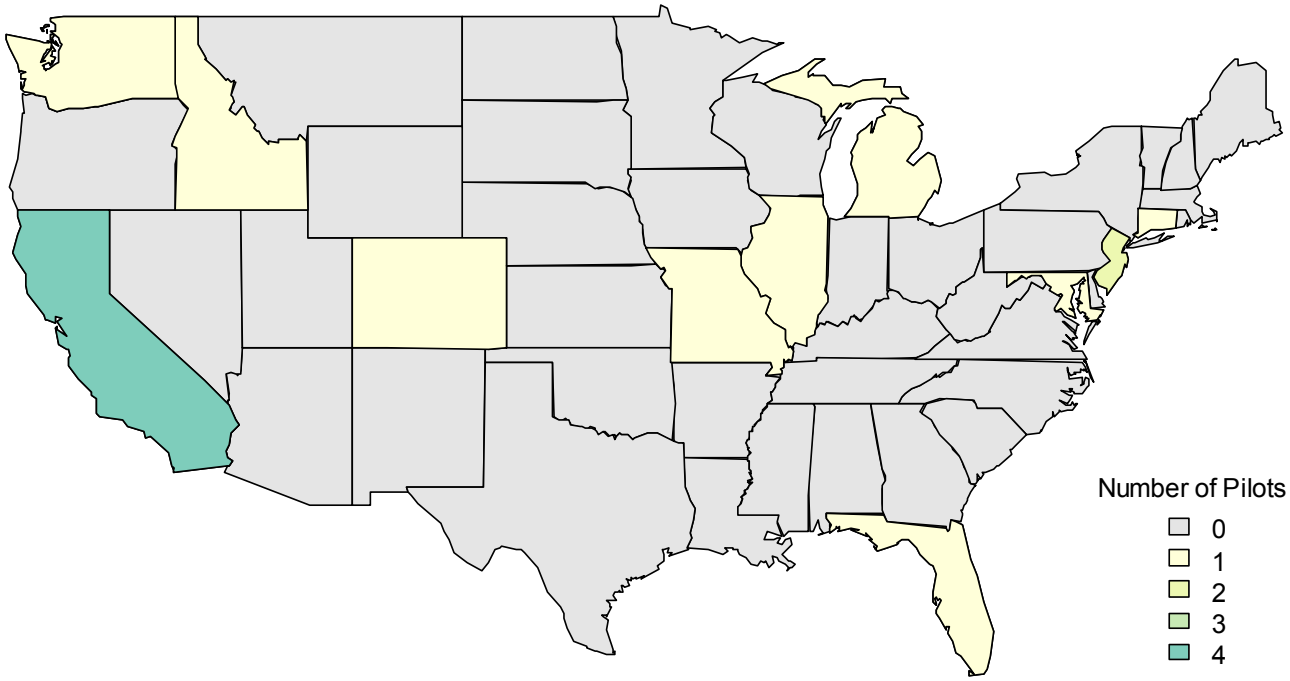
Source: Adapted from 2010 FERC Assessment of Demand Response & Advanced Metering

Comments

- 53 GW of peak reduction
- ~6% of U.S. peak
- Only 20% residential
- The rest is split between commercial, industrial, and wholesale

Recent DR research has focused largely on residential dynamic pricing

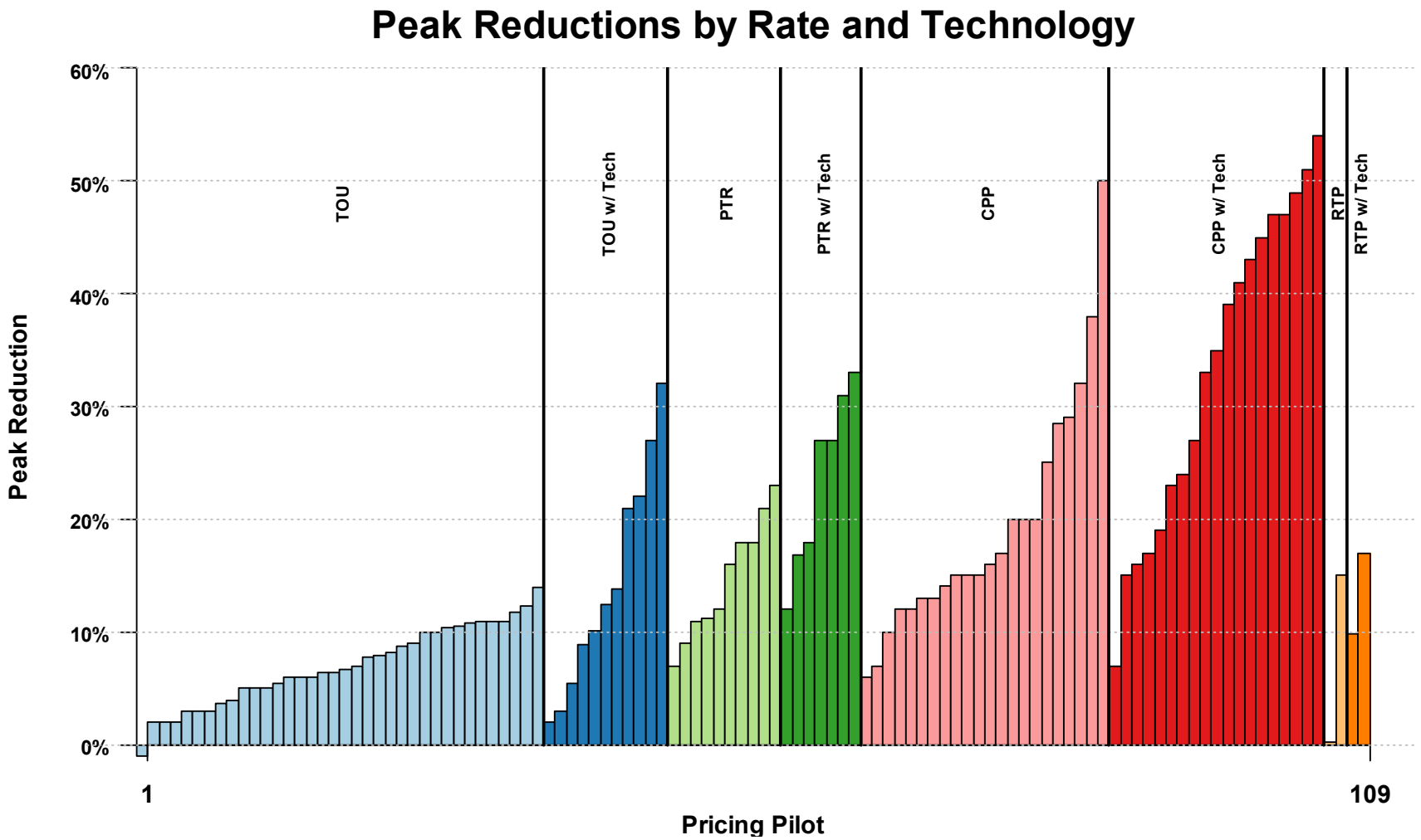
18 Recent Residential Pricing Pilots



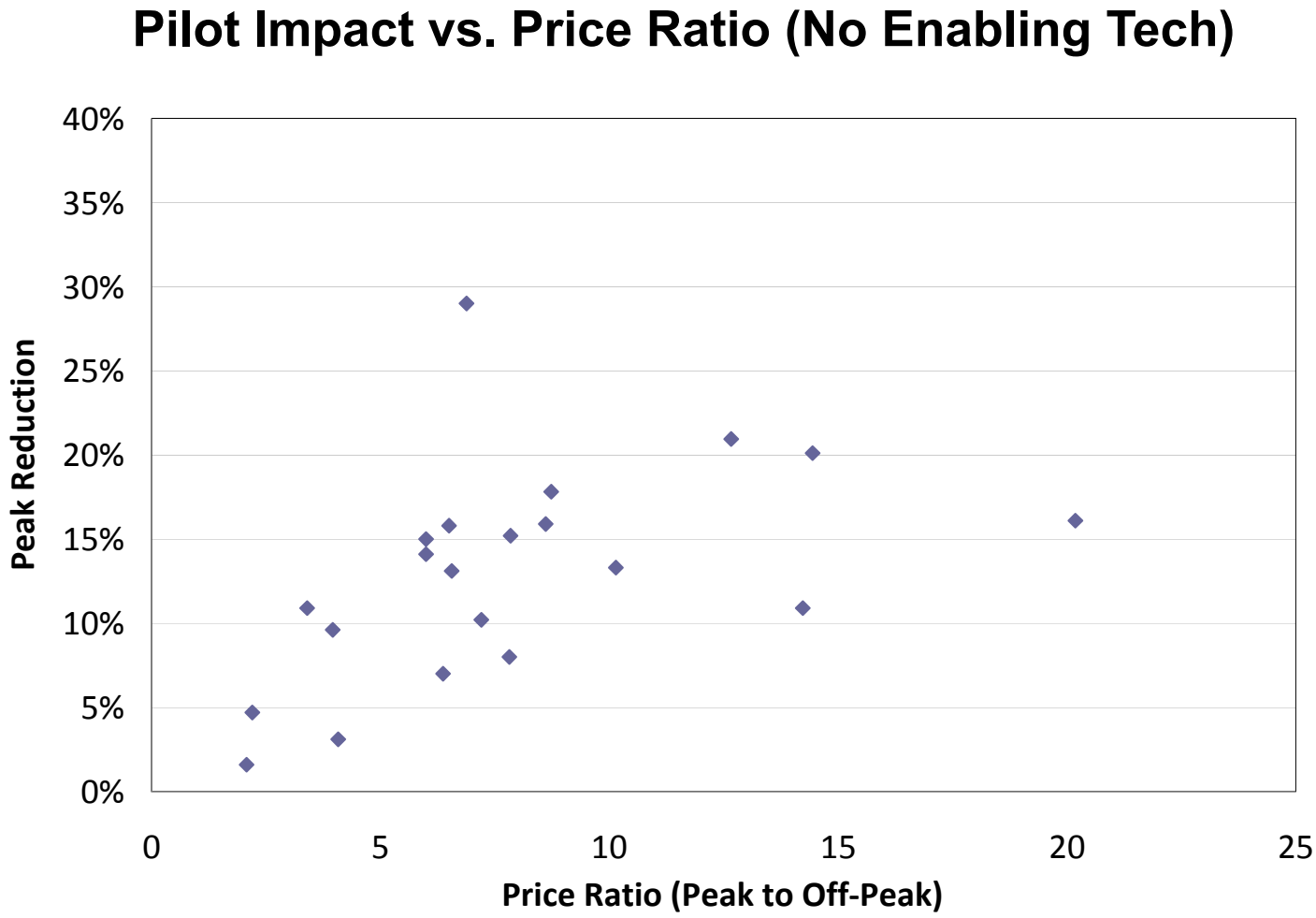
Note: Map excludes full-scale rollouts such TOU rates at APS and SRP

International pilots include Australia and Canada

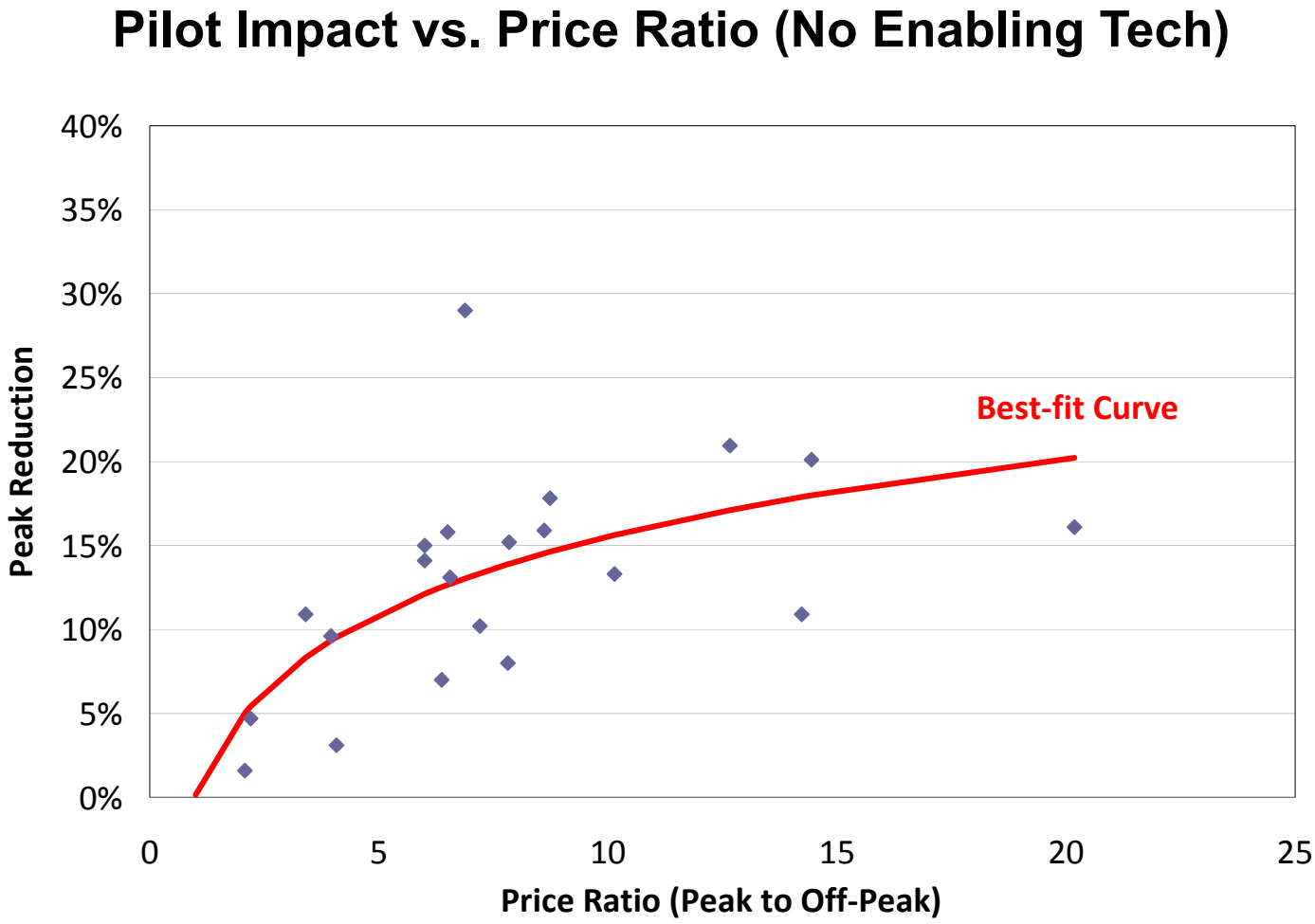
More than 100 combinations of rates and technologies have been tested



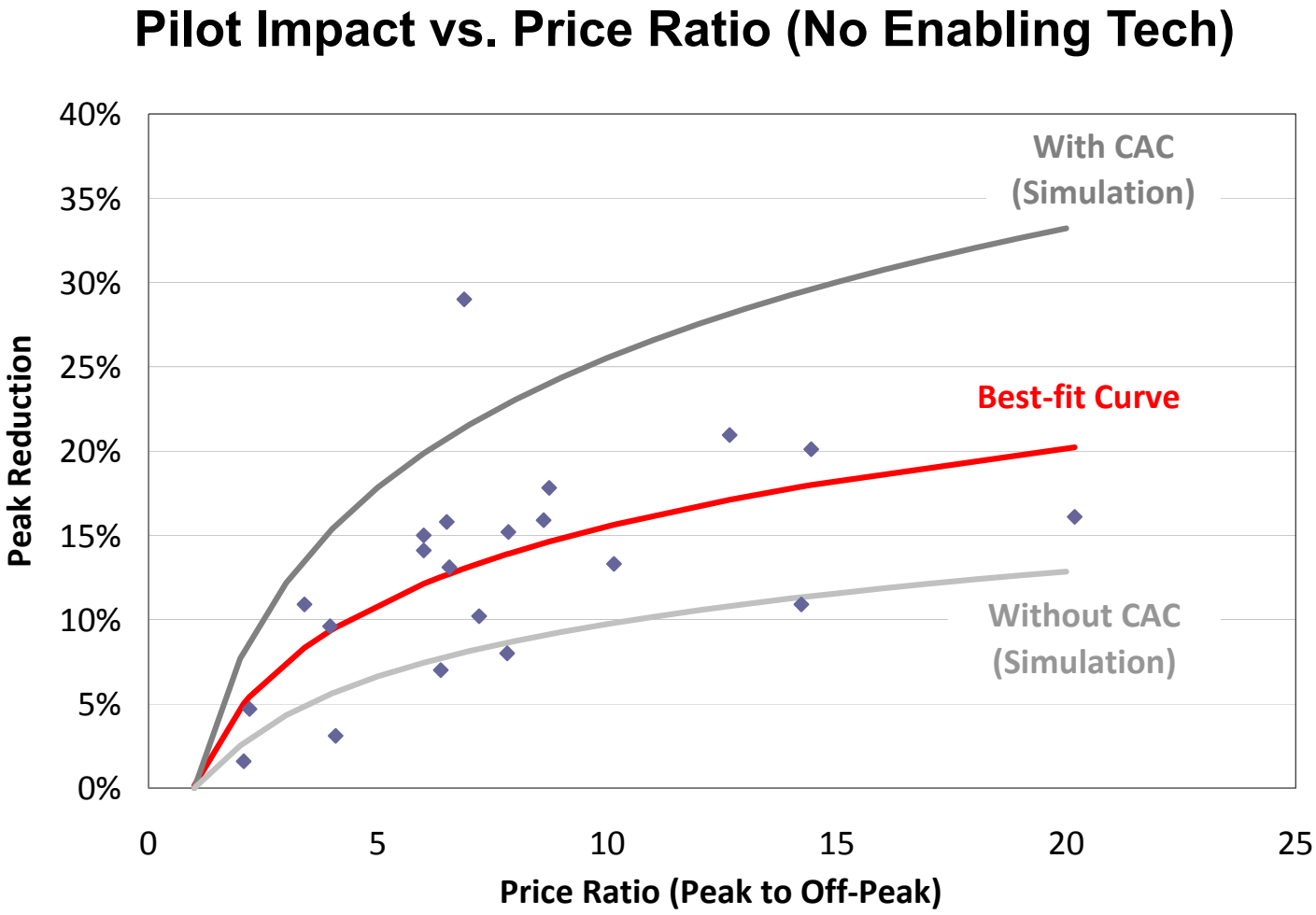
The pilots show that the strength of the price signal influences customer responsiveness



Responsiveness increases at a decreasing rate

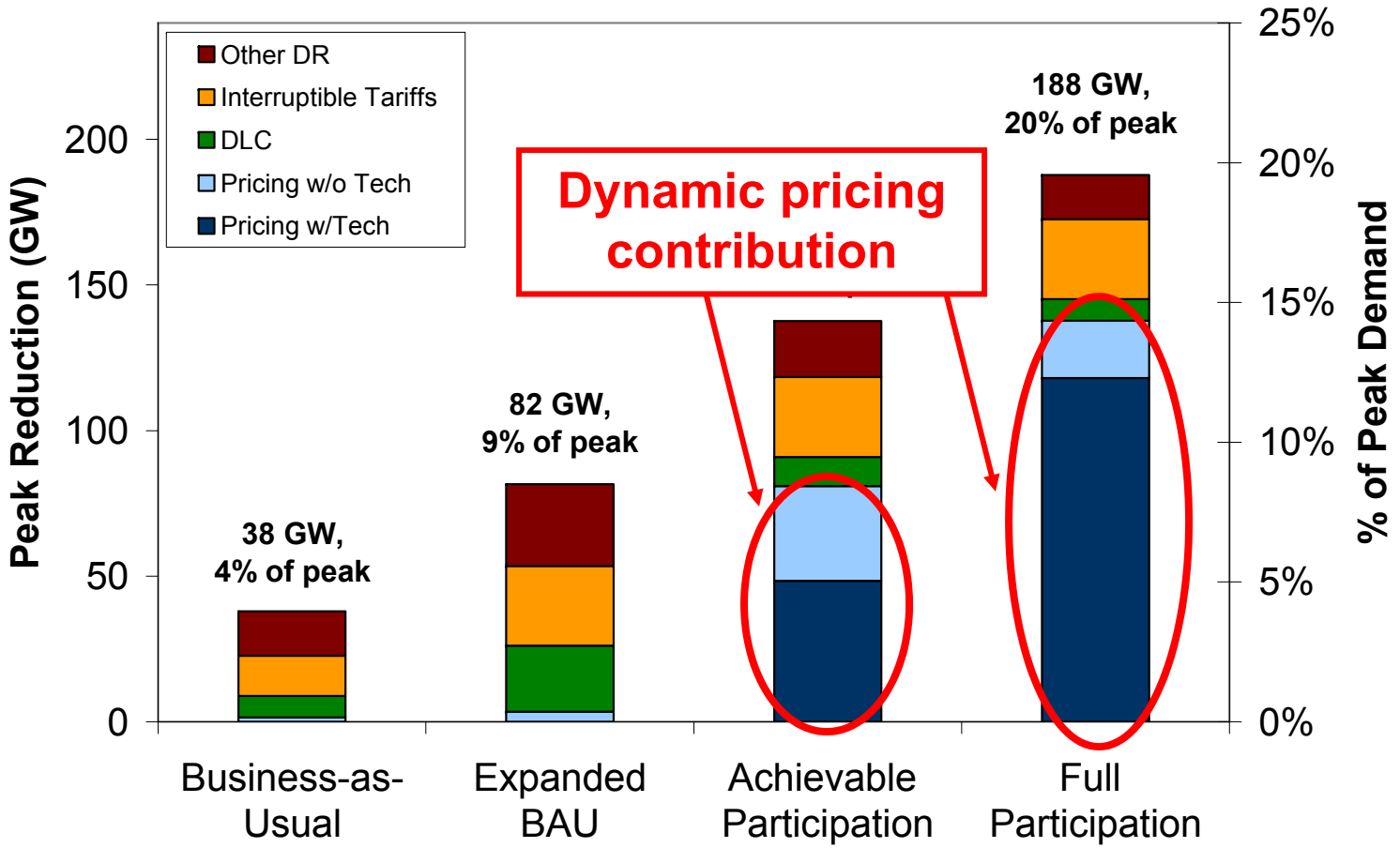


Results are mostly within a range explained by central air-conditioning saturation



However, while much of the potential is in dynamic pricing…

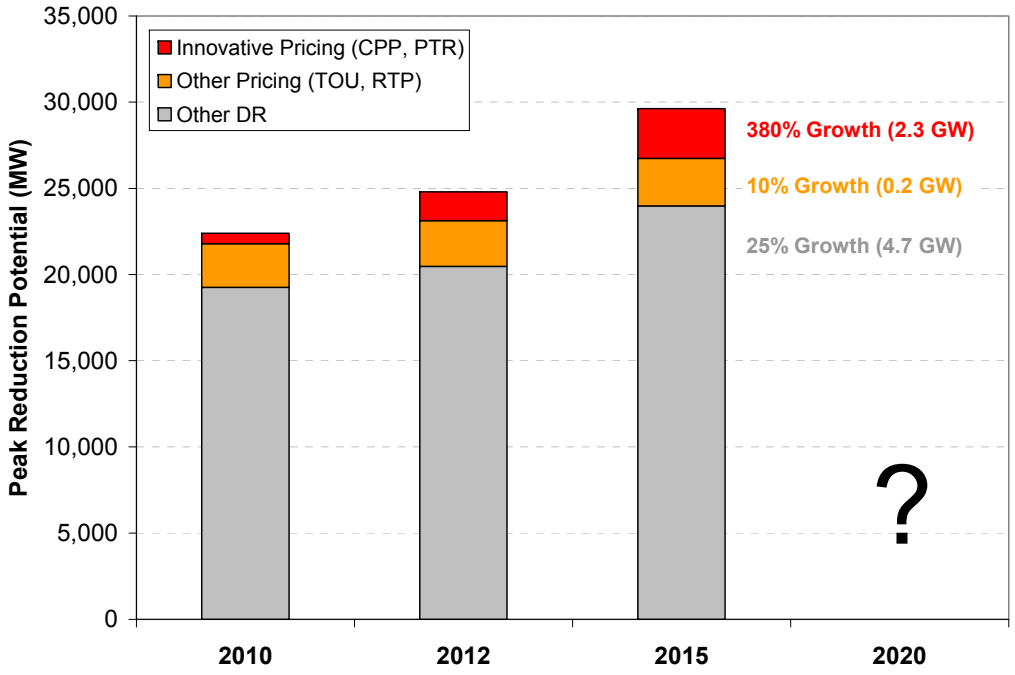
U.S. Peak Demand Reduction Potential by 2019



Source: 2009 FERC National Assessment of Demand Response Potential

…plans for new DR programs are only partly consistent with the potential estimate

Utility Projections of New U.S. DR Programs



Source: Adapted from 2010 FERC Assessment of Demand Response & Advanced Metering

Comments

- The share of dynamic pricing in planned new programs will increase in the next five years
- However, non-pricing programs will still represent majority of new DR through 2015

New concepts will be tested in DOE-funded consumer behavior studies

- Variable peak pricing
- PTR as a transition tool
- Technology acceptance
- Pre-payment billing
- Sample selection methods
- Pricing period duration
- Bill protection
- Information access patterns
- Enhanced education
- Test-and-learn

Other funded pilots are still under review

DR could add value in new ways in the future

Renewables integration

- Requires frequent interruption and investment in automation technologies – will customers participate?
- A study on potential value of DR in integration would help to quantify the magnitude of this opportunity

Plug-in electric vehicles

- Distribution-level reliability is a near-term challenge with clustered adoption
- The effectiveness of TOU rates will depend on the price elasticity of charging
- Some form of charging control will be critical at high adoption rates

Permanent load shifting

- How do the economics change with significant addition of renewables?
- Are retail price signals sufficient to encourage adoption where economic?

Creating shareholder value

- In an environment of rising retail rates, regulators are likely to become increasingly cost-conscious
- Can the cost-saving nature of DR improve the utility's bottom line?